SECTION 03300: CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 RELATED WORK

A. Section 03100: Concrete Formwork

B. Section 03200: Concrete Reinforcing

C. Section 03345: Concrete Finishing

1.02 REFERENCE STANDARDS

Conform to requirements of the following Reference Standards or as modified and supplemented hereinafter.

A. ACI Specifications for Structural Concrete for Buildings, ACI 301

B. ACI Recommended Practice for Selecting Proportions for Concrete, ACI 613.

C. ACI Recommended practices for Cold Weather Concreting, ACI 306.

D. ACI Recommended Practice for Hot Weather Concreting, ACI 605.

1.03 QUALITY ASSURANCE

A. Special Inspection: Notify the Engineer at least 48 hours before inspection will be required; inspection will be required immediately prior to any intended pours or placement of concrete.

B. Concrete Work: Concrete work, where indicated, shall be exposed, as finished. Special care must be taken to provide specified, finished surfaces without gravel pockets, and other defacements.

C. Concrete work shall be performed by a company specializing in cast-in-place concrete with a minimum five years experience. Any

work not conforming to the construction documents shall be rejected, removed and replaced.

1.04 SUBMITTALS

A. Submit, for approval, product data per Section 01340 for joint filler; and mixtures and curing compounds for all cast-in-place concrete work. Submit concrete design mix.

B. Refer to Section 03100 for additional requirements.

C. Mockups: Prepare mockup per Section 01340 of natural color Portland cement with broom finish and one expansion joint. Protect mockup on-site until concrete work is accepted.

D. Records: Maintain records of all concrete placements; indicate exact mix proportions, list time, date, location in the Project, weather conditions at the time of placement, and the source of the concrete supply. Make records available to Engineer at any time during the course of construction and submit at end of concrete placement phase of Project for the purposes of preparing record documents.

E. Certificates: Submit certification of previously tested mix designs.

PART 2 –PRODUCTS

2.01 CONCRETE MATERIALS

A. Aggregates:

Standard: ASTM C33

B. Cements:

1. Provide cements obtained from same source or of same brand for concrete in same element or portion of the work.

2. Standard Portland Cement: Columbia, Ideal, Kaiser, Lone Star, or approved. Standard gray Portland cement, ASTM C150; uses type I or type III.

C. Cementious Materials:

Fly ash, ASTM C618 type F, except that the maximum allowable loss on ignition shall be 0.75 percent. Use for all concrete.

D. Admixtures:

1. Use only one brand of admixtures.

2. Water-Reducing Admixture: Master Builders Pozzolith 300-N, or approved. Chemical admixture conforming with requirements of ASTM C494, Type A.

3. Retarder-Densifying Admixture: Master Builders Retarding Pozzolith, or approved; ASTM C494, Type B.

4. Accelerator: Chemical admixture designed to accelerate set on concrete but not corrode reinforcing steel; ASTM C494, Type C.

5. Air Entraining Agent: Conform to requirements of ASTM C260.

E. Other Ingredients:

Provide other ingredients as indicated or as required by Code or Reference Standards.

2.02 CONCRETE MIX

Concrete mix shall have the characteristics as follows:

28 day compressive strength.....3,000, psi
Sacks cement.....5 per cubic yard
(see "Cement" below)
Fine aggregate #2 .....203 per sack, lb.
(see "Aggregates" below)
Coarse aggregate #5.....320 per sack, lb.
(see "Aggregates" below)
Maximum water, gallons per sack 5.5
Slump, inches.....2.0 to 3.5 per ASTM C143
Water-cement ratio (air entrained).....0.46

2.03 PORTLAND CEMENT

Use only Type II Portland Cement, as specified in d AASHTO M 85. Use one brand and color of cement for all exposed concrete.

2.04 AGGREGATES

A. Fine Aggregates:

Fine Aggregates shall consist of sand or other inert materials, or combinations thereof, having hard, strong, durable particles free from an adherent coating. Fine Aggregate shall be washed thoroughly to remove clay, loam, alkali, organic matter, or other deleterious matter. Fine Aggregate #2 Particle Gradation is as follows:

Sieve Size	**Percent Passing**
#4	95% to 100%
#8	85% to 95%
#16	45% to 85%
#30	40% to 60%
#50	10% to 30%
#100	2% to 10%
#200 (wet)	0% to 2.5%

B. Coarse Aggregates:

Coarse Aggregate shall consist of gravel, crushed stone, or other inert material or combination thereof having hard, strong, and durable pieces free from adherent coatings. Coarse Aggregate shall be washed to thoroughly remove clay, silt, bark, sticks, alkali, organic matter, or other deleterious material. Coarse Aggregate Particle Gradation is as follows:

Sieve Size	**Percent Passing**
1/2 inch square	100%
3/4 inch square	80% to 100%
3/8 inch square	10% to 40%
#4	0% to 4%

2.05 BONDING AGENTS AND ADHESIVES

A. Bonding Agents as required.

B. Primers and Sealers: As recommended by the adhesive and bonding agent manufacturers.

2.06 EXPANSION JOINTS

A. Joint Filler: Pre-formed, non-extruding asphalt impregnated resilient material; ASTM D1752, Type I, 3/8 inch wide by depth required to bring top surface within ½ inch of slab surface.

B. Joint Sealer: Self-leveling polyurethane; ASTM C920, Type M, Grade SL, Class 25. Color: gray.

C. Expansion Joint Cap: Removable, high impact extruded polystyrene, placed on joint filler during concrete placement. Joint cap by Burke Company or equal.

2.07 CONCRETE MIXES

A. Quality of Concrete: Assumed compressive strengths and locations of same are noted on Drawings.

B. The fly ash content shall not exceed seven percent by weight of the total cementious material.

C. Admixtures:

1. Add in accordance with manufacturer's directions.

2. If approved, water-reducing retardant may be used when the temperature of the concrete, as placed, exceeds 65°F.

3. If approved, accelerator may be used when temperature of concrete is less than 40°F.

4. No calcium chloride or other water-soluble chloride ion admixtures will be permitted, unless otherwise approved by Engineer.

5. Use retarder/densifier when placing other concrete in warm weather conditions or when ambient temperature exceeds 65°F.

6. Use air-entraining agent in concrete subjected to freezing temperatures after curing. Total air content shall be in accordance with Table 26-B of UBC.

2.08 PROPORTIONING

A. General: Concrete for all parts of the work shall be homogeneous and when hardened, shall have the required strength, resistance to abrasion, watertightness, appearance, resistance to deterioration, durability, and other properties specified herein.

B. Slump. Slump for concrete as determined by "Method of Test for Slump of Portland Cement Concrete" ASTM C 143-69, shall be two to three and a half inches.

C. Proportion of Ingredients: Proportion ingredients to produce the proper placeability, durability, and strength.

D. Proportion ingredients to produce a mixture which will work readily into the corners and angles of the forms, and around reinforcement by the methods of placing and consolidation employed on the work, but without permitting the materials to segregate, or excessive free water to collect on the surface.

2.09 MIXING CONCRETE

Standard Concrete -- Ready-Mixed Concrete: Mix and transport in accordance with ASTM C94.

Slump: Mix concrete only in quantities for immediate use. Do not make indiscriminate addition of water to increase slump. When concrete arrives at the Project with slump below that suitable for placing, water may be added only if the maximum permissible water-cement ratio or the maximum slump is not exceeded, and only at the direction of the Engineer.

PART 3 –EXECUTION

3.01 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete any unfinished formwork, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers,

place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least six inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

E. Cold Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing action, or low temperatures.

F. When air temperature has fallen to or is expected to fall below, 40°F (4°C), uniformly heat water and aggregates before mixing, to obtain a concrete mixture temperature of not less than 50°F (10°C) and not more than 80°F (27°C), at point of placement.

1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen sub-grade or on sub-grade containing frozen materials.

2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

G. Hot Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90°F (32°C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover reinforcing steel with water soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

3. Fog spray forms, reinforcing steel, and sub-grade just before placing concrete. Keep sub-grade moisture uniform without puddles or dry areas.

4. Use water reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Engineer.

3.02 CONSTRUCTION JOINTS

A. Form all joints perpendicular to main reinforcement. Continue reinforcing across joints, unless otherwise indicated; provide longitudinal keys at least 1-1/2 inch deep at all joints in walls between walls and slabs or footings. Remove key forming wood inserts and thoroughly clean surface of concrete at all joints before placing next lift.

B. Roughen surface of concrete at joints and remove laitance to obtain bond before placing next lift; if use of keys is impractical due to congestion or inaccessibility or if it is inadvisable to disturb surface

before it has hardened, use only wet sandblast method for preparing surface.

C. Dampen hardened concrete of joints between footings and walls, joints in unexposed walls, and all others not specifically mentioned here in after and roughen by air water cutting.

D. Dampen hardened concrete joints in exposed work and roughens by air/water cutting. Thoroughly cover joint surfaces with neat cement mortar of similar proportions to mortar in concrete; apply mortar as thick as practicable on vertical surfaces and a minimum of 1/2 inch thick on horizontal surfaces; place next lift before mortar has reached its initial set.

E. For bonding new concrete to existing concrete use bonding agent. For grouting dowels and reinforcing bars use specified adhesives in accordance with manufacturer's instructions.

F. Provide key forming wood inserts strips in walls; pour concrete to 1/2 inch above lower edge or strip.

3.03 EXPANSION JOINTS

A. Provide pre-molded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.

B. Locate expansion joints as noted on Drawings.

C. Extend joint fillers full width and depth of joint and not less than 1/2 inch or more than 1 inch below finished surface where joint sealer is indicated. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together. Protect top edge of joint filler during concrete placement with expansion joint cap. Remove joint cap protection after concrete has cured and been placed on both sides of joint and before sealant is applied.

D. Fillers and Sealants: install polyurethane sealant in a continuous, smooth joint, wiping excess sealant from adjacent concrete.

E. Provide expansion joints at spacing shown on Drawings and not more than 30 feet apart in footings. Run no reinforcement or other metal trim continuous through joints, unless otherwise indicated.

3.04 CLEANING

Leave premises clean and free of residue from work in this section.

END OF SECTION 03300